APPENDIX 9

Summaries of WRAP 1996 and MAG's 1999 Emissions Inventories

Appendix 9: Summary of Emissions Data Development for July 12, 2002 SMOKE Modeling Run

Emissions modeling for the greater Phoenix area was conducted by Arizona State University for ozone episode days June 6, 2002, and July 12, 2002. The air quality modeling domain for the VOC and NOx simulations was approximately 350 miles wide in the east-west (New Mexico to Colorado River) and 200 km in the north-south (Flagstaff to Nogales) directions, with metropolitan Phoenix in the center. This area included all of Maricopa, Pima, and Pinal Counties. A modeling domain of this size ensures that emissions and air quality in areas near greater Phoenix, the area of greatest interest, are accounted for in the analysis; as source and receptor areas are included and boundary conditions characterized.

The modeling domain was then divided into two - an inner 2 km grid resolution domain and an outer domain with a grid resolution of 6 km in which the inner domain was nested. The emissions inventory for the outer domain, which covers almost the entire State of Arizona, was based on the inventory data of the Western Regional Air Partnership (WRAP) base case scenario 1996 Emissions Inventory. Previously, issues regarding this inventory were identified by the Arizona Regional Haze SIP Emission Inventory Work Group, another stakeholder group assisting ADEQ. The Work Group submitted a letter to WRAP with suggested improvements to the emissions inventory (see Attachment 1). However, time constraints necessitated that, for this 8-hour ozone analysis, the available WRAP inventory be used.

For the inner modeling domain the emissions inventory for the MAG 1-hour ozone maintenance plan was used. (see Attachment 2).

Monthly and weekday adjustments were applied to anthropogenic emissions estimates for the two ozone episodes, and emissions were processed for typical weekdays in June and July.

In addition, biogenic emissions were modeled for the June and July 2002 episodes. The biogenic emissions modeling for the inner modeling domain, covering the Phoenix Metropolitan area was carried out by MAG. The biogenic emissions modeling for the outer domain was based on land cover data obtained from EPA's BELD3.0 km resolution database (ftp://ftp.epa.gov/amd/asmd/beld3/ascii/). The BELD3.0 land cover database has been developed for use with regional and urban air quality simulation models. Its immediate application is to provide spatial and vegetation species resolution for the Biogenic Emissions Inventory System (BEIS). The BELD3.0 land cover data are relatively current, and include 232 different plant species. BELD3.0 has been assembled from three major land cover databases:

(1) The USGS North America Land Cover Characteristics Data Base with a 1-km nominal spatial resolution is based on 1-km AVHRR satellite data spanning April

1992 through March 1993. In addition, a core set of derived thematic maps produced through the aggregation of seasonal land cover regions are included. Information on this database can be found in http://edcwww.cr.usgs.gov/landdaac/glcc/na_int.html.

(2) The US Forest Service's Forest Inventory Analysis (FIA) data set.

(3) The US Department of Agriculture crop acreage statistics at the county level for 1992.

As can be expected, relatively high VOC emissions were simulated for areas with agricultural land use as well as in areas where a significant fraction of desert trees such as mesquite and acacia (usually found in riparian areas and high desert) or, for the higher elevations, juniper, oak and pine trees. Low desert areas were not characterized by an abundance of desert trees and, therefore, low VOC emissions were estimated. Emissions estimates for higher elevation areas, where chaparral, pinion-juniper woodland and pine forest occur, were significantly higher than for the desert areas.

Attachment 1

Review of 1996 WRAP Emissions Inventory For Use in Arizona's Regional Haze State Implementation Plan

Emissions Inventory Workgroup

November 25, 2002

EXECUTIVE SUMMARY

The Emissions Inventory Work Group (EIWG) reviewed the 1996 Western Regional Air Partnership's (WRAP) Emissions Inventory (EI) for use in Arizona's Regional Haze SIPs submitted after Year 2003. The majority of the review was based on comparisons between the WRAP EI and local emissions inventories developed by Maricopa County, Maricopa Association of Governments, Pima County, Pima Association of Governments, and Pinal County. Following is a summary of the EIWG's review and recommendations to ADEQ for working with WRAP to enhance WRAP emission source categories:

1. **Onroad Emissions** - The vehicle miles traveled (VMT) data in the 1996 WRAP EI were larger than the VMT data in local emissions inventories and did not match the seasonal allocation of VMT. The EIWG suggests that local VMT data be used for developing the mobile onroad emissions for Arizona Regional Haze SIPs submitted after Year 2003, with particular attention to allocating VMT by season, because Arizona does not follow the national pattern for maximum VMT occurring during the summer season.

2. **Nonroad Emissions** - Generally, the nonroad emissions data in the 1996 WRAP EI were higher than the nonroad emissions data in local emissions inventories. Since the temporal pattern of nonroad equipment activity in Arizona can be quite different from the national average, the EIWG recommends that local Arizona nonroad emissions data be used in the Arizona Regional Haze SIPs submitted after Year 2003.

3. **Point Sources** - Emissions data for point sources, greater than 100 tons per year, in the 1996 WRAP EI were larger than the emissions data for Maricopa County, and much larger than the point source emissions data in Pima County and Pinal County emissions inventories (e.g., as much as an order of magnitude for PM10 emissions from point sources in Pima County). In July 2002, both Maricopa and Pima Counties submitted corrected point source emissions data to WRAP's contractor. The EIWG recommends that emissions data from the state, local governments, and tribal entities be used instead of national surrogates for Arizona Regional Haze SIPs submitted after Year 2003. The EIWG also recommends that a decision be made whether fugitive dust emissions should be included as part of the point source inventory for Arizona Regional Haze SIPs submitted after Year 2003.

4. **Area Sources** - Emissions data for area sources in the 1996 WRAP EI were in relatively good agreement with the emissions data in Maricopa County (except for certain subcategories such as NOx from stationary source fuel combustion, which were grossly overestimated), but were not in good agreement with the emissions data for area sources in Pima County. The EIWG suggests that area source emissions in the WRAP EI be reviewed for accuracy before these data are used in Arizona Regional Haze SIPs submitted after Year 2003.

5. **Forest Fires** - The WRAP EI and the Arizona Smoke Management Program may use different emission factors (but use the same activity data) to estimate emissions from forest fires. The EIWG suggests that forest fire emissions from the WRAP EI be compared to the Arizona Smoke Management Program's and for WRAP to lobby USEPA to use the most current emission factors for estimating emissions from forest fires (currently WRAP is using AP-42 emission factors).

6. **Agricultural / Rangeland Burning** - Emissions data on agricultural / rangeland burning are planned to be included in the WRAP's Year 2018 Fire EI. The EIWG suggests that the WRAP's emissions estimates for this category be used, since little data are collected on agricultural / rangeland burning in Arizona. In the future, a statewide tracking system for the location, size, fuel type, fuel loading, and time of burning would greatly benefit the understanding of the contribution of this emission source to regional haze.

7. **Biogenics** - The WRAP biogenic emission estimates for Maricopa County are much smaller than those calculated by the Maricopa Association of Governments (MAG) estimates. The EIWG plans to investigate this discrepancy further after receiving biogenic emissions data grouped by counties from the WRAP Modeling Center at the University of California - Riverside.

8. **Wind Erosion** - This emission category is scheduled to be added to the WRAP EI after completion of a WRAP research contract. Estimating emissions from wind erosion entails accounting for a number of factors including local variations in soil type, wind patterns, precipitation patterns, vegetation growth, and topography. Due to the inherent complexity of developing wind erosion estimates for a region as large as Arizona, the EIWG suggests that the wind erosion data produced by the WRAP's contractor be used in Arizona Regional Haze SIPs submitted after Year 2003.

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ACRONYMS AND ABBREVIATIONS

ADEQ Arizona Department of Environmental Quality
ATR Automated Traffic Recorders
CO Carbon Monoxide
EI Emissions Inventory
EIWG Emissions Inventory Work Group
EPA United States Environmental Protection Agency
GCVTC Grand Canyon Visibility Transport Commission
GIS Geographic Information System
HPMS Highway Performance Monitoring System
MAG Maricopa Association of Governments
MCESD Maricopa County Environmental Services Division
NEI National Emissions Inventory
NH3 Ammonia
NOx Nitrogen Oxides
PAG Pima Association of Governments
PM10 Particulate Matter Less Than Or Equal To 10 Microns
PM2.5 Particulate Matter Less Than or Equal to 2.5 Microns
SIP State Implementation Plan
SO2 Sulfur Dioxide
U.S. United States
USEPA United States Environmental Protection Agency
VMT Vehicle Miles Traveled
VOC Volatile Organic Compounds
WRAP Western Regional Air Partnership

BACKGROUND

Federal Mandate

As part of the Clean Air Act Amendments in 1977, Congress set a national goal of remedying existing visibility impairment, and preventing future impairment, from manmade pollution at the 156 national parks and wilderness areas across the United States (see Figure 1 for map of Arizona Class I Areas). Section 169 A was added to the Clean Air Act to address visibility impairment from existing stationary sources operating in and near national parks or wilderness areas. In this case, the visibility impairment could be found directly associated with or caused by the stationary source (i.e., reasonably attributable). Section 169B was added to address visibility impairment due to regional haze. Regional haze is defined as, "visibility impairment that is caused by the emission of air pollutants from numerous sources located over a wide geographic area. Such sources include, but are not limited to, major and minor stationary sources, mobile sources, and area sources." (40 CFR § 51.301). The Regional Haze Rule, adopted July 1, 1999, requires states to develop programs to assure reasonable progress toward meeting the national visibility goal. The way in which states develop and implement programs to address air pollution is through a state implementation plan (SIP) [1].

History - ADEQ

The state of Arizona has been actively involved in visibility and regional haze issues, beginning with the Grand Canyon Visibility Transport Commission (GCVTC) and continuing with the Western Regional Air Partnership (WRAP), the successor organization to the GCVTC. Each Arizona work group has a designated person to monitor the WRAP process and report items of interest and concern to the relevant group. The WRAP forums are expected to produce many work products that will be available for Arizona's consideration as it develops its Regional Haze SIP.

Beginning in August 2001, ADEQ launched Phase 1 of a stakeholder process to determine which schedule to follow in its development of a Regional Haze SIP. The federal Regional Haze Rule provides two choices for states and Indian tribes in the nine state GCVTC region. States submitting SIPs in 2003 will be implementing GCVTC recommendations per 40 CFR § 51.309 ("309 SIP"). States submitting SIPs in the 2004-2008 time frame will be focusing on a broader range of sources and programs, per 40 CFR § 51.308 ("308 SIP").

The stakeholder process that began in August 2001 ended in early November 2001 with a consensus that ADEQ pursue the option to submit a SIP by December 31, 2003, in accordance with 40 CFR § 51.309. The stakeholders further agreed that the SIP should include the eight Arizona mandatory Federal Class I areas outside of the GCVTC region in addition to the four GCVTC region Class I areas [1].

ARIZONA CLASS I AREAS

ALL CLASS I AREAS

- Federal Class I Areas
- GCVTC Class I Areas
- State Boundaries
- Major Freeways
- Major Cities

For more information about this map contact:

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Disclaimer Information:
This map is a (WORKING DOCUMENT), it is designed for presentation and discussion and is subject to change and further refinement.

July 2000

Role of Emissions Inventory Workgroup

The Emissions Inventory Work Group is responsible for the review and recommendation of emission baseline and projections used in the SIP analysis. Specific responsibility areas include:

- Develop and review emission inventory work products, as needed.
- Review WRAP emission inventories/projections.
- Consult with long-term strategy work groups to identify data gaps, and review projections of the effect of long-term strategies on emissions.
- Develop updates for emission inventories/projections to be forwarded to the WRAP Regional Modeling Center [1].

WRAP Emissions Inventory

The 1996 WRAP emissions inventory (EI) includes four separate inventories for point sources, mobile sources, area sources, and fire by county for the thirteen states that are WRAP members. ADEQ and some counties in Arizona supplied point source emission estimates to the WRAP point source EI. The mobile source emissions were compiled by the WRAP Mobile Sources Forum using EPA's MOBILE6 and NONROAD emissions models for onroad and offroad sources. Arizona area source emissions in the WRAP EI were based on estimates from the 1996 National Emissions Inventory and did not include geogenic wind blown dust from undisturbed natural soils. Fire emissions were compiled by the WRAP Fire Emissions Joint Forum [2].

DISCUSSION

The Emissions Inventory Workgroup (EIWG) has met four times: June 19, 2002; July 17, 2002; August 14, 2002, and September 16, 2002. During these meetings, EIWG members reviewed the Arizona portion of the WRAP EI, discussed the methodology used to develop the WRAP EI and how to utilize the WRAP EI in Arizona Regional Haze SIPs submitted after Year 2003 (e.g., 309G / 308 SIPs), and suggested enhancements to the WRAP EI for making Year 2018 forecasts. The following sections summarize the EIWG members' review of the methodology and emissions data for the 1996 WRAP EI source categories.

Mobile Sources

Onroad Emissions - Maricopa County

Based on very limited model-compatible data, the WRAP EI's onroad CO emission rates for 1996 are comparable to MAG estimates for 1994 (Table 1). The WRAP EI does overstate 1996 Maricopa County VMT by about 8% in the winter (CO), 13% on an average annual day (PM-10), and 25% in the summer (VOC, NOx). In addition, WRAP summer season VMT in 1996 (from onroad spreadsheet) is 13% higher than winter VMT. This is opposite to MAG's VMT data that shows higher VMT in the winter than in the summer.

Table 1 – Maricopa County Vehicle Miles Traveled	
1996 WRAP Onroad Inventory	71,538,442 mi/day
1996 MCESD Onroad Inventory	51,329,514 mi/day
Difference	20,208,928 mi/day
% Difference	-28.2%

Both emissions inventories did use the MOBILE6 emissions model. The higher WRAP VMT estimates in the summer would explain some, but not all, of the higher VOC and NOx emissions listed for Maricopa County in the WRAP EI.

Onroad Emissions - Pima County

For Pima County, the local VMT value used for the Pima Association of Government's (PAG) 2003 Transportation Improvement Program (TIP) is 10.93% lower than the Year 2003 VMT (average over 4 seasons) used for the WRAP EI. It is also important to note that the Year 2003 VMT used for the TIP only applies to eastern Pima County, which is the transportation planning area. The results are displayed in Table 2.

Table 2 – Pima County Vehicle Miles Traveled	
2003 WRAP Onroad Inventory	21,760,515 mi/day
2003 TIP	19,382,125 mi/day
Difference	2,378,390 mi/day
% Difference	-10.93%

The WRAP average annual daily VMT for Pima County (1996) is 19.4% higher than the Highway Performance Monitoring System (HPMS) average annual daily VMT for Pima County (1996). A discrepancy also exists with the seasonal VMT allocation in the WRAP EI for Pima County. The highest VMT for the WRAP Onroad EI was applied to the summer season. However, the summer season in Pima County typically yields the lowest VMT, with the spring season having the highest VMT. Table 3 lists the onroad emissions in the WRAP EI and the PAG EI.

Table 3 – Pima County Onroad Emissions (tons per day)			
	VOC	**NOx**	**CO**
2003 WRAP EI	57.8	53.6	517.7
2003 PAG Onroad Mobile	37.3	55.9	370.7
% Difference	-35.5%	+4.3%	-28.4%

Nonroad Emissions - Maricopa County
1996 Maricopa County periodic inventories are lower than the WRAP EI for VOC (-43%) and NOx (-84%), and slightly higher (+21%), for CO (Table 4). Note that the periodic inventories were developed for a smaller CO/Ozone Nonattainment Area of about 2,000 square miles versus Maricopa County, which is 9,200 square miles in area, which was used for the WRAP EI. The EPA NONROAD model used by WRAP is known to overstate nonroad activity levels. It is understood that a new and improved NONROAD model will be used by WRAP in the future. This should reduce some, if not all, of the disparity between WRAP's and Maricopa County's estimates of VOC and NOx emissions.

Table 4 – Maricopa County Nonroad Emissions (tons per day)				
	VOC	**NOx**	**CO (winter)**	**PM10**
1996 WRAP EI	115.4	196.7	375.1	13.8
1996 MCESD EI	66.3	32.0	452.4	NA
%Difference	-42.5%	-83.7%	+20.6%	NA

Nonroad Emissions - Pima County
PAG developed a nonroad mobile source inventory for the Year 2000. The PAG EI nonroad mobile emission estimates were compared with the Year 1996 nonroad mobile emissions estimates (tons/day) for the WRAP EI and are listed in Table 5.

Table 5 – Pima County Nonroad Emissions (tons per day)						
	VOC	**NOx**	**CO**	**PM10**	**PM2.5**	**SO2**
1996 WRAP EI	19.30	35.30	220.89	3.82	3.57	6.74
2000 PAG EI	16.53	20.75	198.90	2.56	2.35	4.90
%Difference	-14.4%	-41.2%	-10.0%	-33.0%	-34.2%	-27.3%

Note that the area included in the PAG nonroad EI was the Tucson Air Planning Area (TAPA), which includes the bulk of the population within eastern Pima County (~96.5%), while the estimate for the WRAP EI includes all of Pima County.

Point Sources
Maricopa County
The accuracy of the data on large point sources (>100 TPY) in the ***revised*** WRAP EI appears to be in generally good agreement with Maricopa County's EI (Maricopa County submitted updated point source emissions data to WRAP contractors to revise

the WRAP EI). Table 6 compares Maricopa County's emissions with the emissions in the ***original*** WRAP EI. The emissions data that Maricopa County submitted to WRAP in 2001 contained all point sources included in the 1999 periodic emissions inventory for Maricopa County, with some sources having annual emissions as small as ten tons per year. Since the WRAP point source data only includes those sources greater than 100 tons per year, Maricopa County submitted a revised set of point source data to WRAP contractors in July 2002.

Table 6 – Comparison of Maricopa County and Original WRAP Point Source Emissions (tons per year)

	VOC	NO_X	CO
WRAP Maricopa County 1996 EI Base Case	5,866	3,319	736
Maricopa County 1996 EI	1,489	2,536	266
% Difference between local and original WRAP/NEI data	-75%	-24%	-64%
Difference between local and original WRAP/NEI data in Tons	-4,377	-783	-469

Pinal County

There appear to be large discrepancies between the WRAP EI and Pinal County's data on point source emissions. Tables 7 lists the results of comparing the Pinal County's point source emissions with the WRAP EI.

Table 7 – Comparison of Pinal County and Original WRAP Point Source Emissions (tons per year)

	VOC	NO_X	CO	SO2	PM10	PM2.5	NH3
WRAP Pinal County 1996 EI Base Case	144	2,076	483	27,974	2,531	990	2
Pinal County 1996 EI	188	1,059	254	16,678	3,252	267	0.00
% Differences (Increases from using WRAP/NEI data)	*-23.4*	*+96*	*+90.2*	*+67.7*	*-22.2*	*+270.7*	*Na*
Differences (Increases from using WRAP/NEI data) in Tons	*-44*	*+1,017*	*+229*	*+11,296*	*-721*	*+723*	*+2*
Grand Total [Differences (Increases from using WRAP/NEI data) in tons]: +10,552							

Pima County

There also appear to be large discrepancies between the ***original*** WRAP EI and Pima County's data on point source emissions. Table 8 lists the results of comparing the Pima County's point source emissions with the original WRAP EI. In July 2002, Pima County also submitted corrected point source emissions data to WRAP contractors and the mentioned discrepancies in Pima County's point source emissions should have been corrected in the ***revised*** WRAP EI.

Table 8 – Comparison of 1995 Pima County and 1996 Original WRAP Point Source Emissions (tons per year)

	VOC	NO_X	CO	SO2	PM10	PM2.5	NH3
WRAP Pima County 1996 EI Base Case	358	9,312	4,827	8,338	11,236	6,308	4
Pima County 1995 EI	56	7,142	5,520	2,787	1,167 (5,116)	NA	NA
% Differences (Increases from using WRAP/NEI data)	*+539*	*+30.4*	*-12.5*	*+199*	*+862 (+119)**	*NA*	*NA*
Differences (Increases from using WRAP/NEI data) in Tons	*+302*	*+2170*	*-693*	*+5551*	*+10,069 (+6,120)**	*+6,308*	*+4*

Grand Total [Differences (Increases from using WRAP/NEI data) in Tons]: +13,995; (+10,046)*

* Totals with Fugitives

Five facilities in Pima County were identified as PM_{10} point sources that emitted more than 100 tons per year in 1996 based on Pima County and ADEQ permitted source records. These facilities and their associated PM_{10} emissions are listed in Table 9.

Table 9 – 1996 Pima County Point Sources (> 100 tons per year)

Permitted By	Facility Name	PM_{10} Total With Fugitives	PM_{10} Total Without Fugitives
ADEQ	Cypress Sierrita (now known as Phelps Dodge Sierrita)	2,633 tons	185 tons
ADEQ	Arizona Portland Cement	1,585 tons	84 tons
ADEQ	Tucson Electric Power	121 tons	121 tons
PDEQ	ASARCO	Unknown	650 tons

PDEQ	Silver Bell Mining L.L.C.	Unknown	127 tons
Total		**4,339**	**1,167**

As shown in Table 9, fugitive PM_{10} emissions can make a significant difference in the PM_{10} emission totals, especially with respect to sources such as mines. Thus, a determination needs to be made whether or not fugitive dust emissions should be included as part of the point source inventory that will be used in Arizona Regional Haze SIPs submitted after Year 2003. If it is determined that fugitive dust emissions should be included in the point source inventory, then this needs to be applied consistently among all of Arizona counties' emissions inventories.

In order to ensure more accurate point and area source emission inventory reporting for future WRAP EI's, the EIWG recommends that WRAP rely more on state/local/tribal entities for emissions data wherever possible, rather than using national surrogates. For example, there was little or no communication between WRAP's contractor and Pinal and Pima counties during the building of the 1996 WRAP EI base case. This resulted in some discrepancies in the emissions for these counties that could have been corrected with input from the counties.

Area Sources

The EIWG reviewed the WRAP EI at the county level, and selected several subcategories for comparison with locally developed emissions estimates.

Maricopa County

Four emissions subcategories, that had the potential for large discrepancies between WRAP and Maricopa County values, were investigated further:

- PM10: WRAP data for PM10 from industrial processes agree well with local 1995 estimates.

- VOC: WRAP estimates of VOC emissions from solvent use appear to be reasonably close to local numbers.

- NOx: WRAP emission values for NOx from stationary source fuel combustion are grossly overestimated for Maricopa County and presumably statewide.

- CO: WRAP data on emissions from waste disposal, treatment and recovery show nearly 9,000 tons of CO emissions from residential incineration in Maricopa County. However, there should be nearly no emissions from this source category because residential incineration is rare in Maricopa County.

Table 10 compares WRAP estimates of area source emissions in Maricopa County with values from the County's 1995 Periodic Emission Inventory.

Table 10 – Comparison of 1995 Maricopa County and 1996 WRAP Area Source Emissions (tons per year)			
	VOC	**NO_X**	**CO**
WRAP Maricopa County 1996 EI Base Case	64,712	36,797	22,470
Maricopa County 1995 EI	39,550	4,589	1,678
% Difference (Increases from using WRAP/NEI data)	-39%	-88%	-93%
Difference (Increases from using WRAP/NEI data) in Tons	-25,162	-32,207	-20,792

Pima County

Area source emission totals in the Pima County portion of the WRAP EI were compared with Pima County's emissions data. The difference in the seven emission categories ranged from a negative 24% to a plus 107%. Table 11 lists the total emissions and differences for area sources in Pima County.

Table 11 – Comparison of 1995 Pima County and 1996 WRAP Area Source Emissions (tons per year)							
	VOC	**NO_X**	**CO**	**SO2**	**PM10**	**PM2.5**	**NH3**
WRAP Pima County 1996 EI Base Case	19,627	4,185	8,435	400	7,294	2,697	1,503
Pima County 1996 EI	9,443	7,822	11,106	2,213	5,786	NA	NA
% Differences (Increases from using WRAP/NEI data)	*+107*	*-46.5*	*-24.1*	*-81.3*	*+26*	*NA*	*NA*
Differences (Increases from using WRAP/NEI data) in Tons	*+10,184*	*--3637*	*-2671*	*-1813*	*+1,508*	*+2,697*	*+1,503*
Grand Total (Difference / Increases from using WRAP/NEI data in tons): +12,029							

Forest Fire

The Arizona Smoke Management Program, conducted by the U.S. Forest Service in conjunction with ADEQ, makes daily decisions on which prescribed fires should be approved based on weather conditions, fuel loading, location of fires, size of fires, and other fires in an air basin. The Arizona Smoke Management Program also tracks wildfire activity in Arizona. Annually, there are approximately 100 days when prescribed burning can take place in Arizona. The decision to approve a prescribed burn must balance both the need to promote forest health and the negative effects of fire on air quality. In the future, the number of prescribed fires will likely increase, while the number of wildfires will probably remain constant. The WRAP EI uses the activity data collected by the Arizona Smoke Management Program. The WRAP EI may use different emission factors than the ones use by Arizona Smoke Management Program; therefore, the EIWG suggests that forest fire emissions from the WRAP EI be compared to the Arizona Smoke Management Program's and for WRAP to lobby USEPA to use the most current emission factors for estimating emissions from forest fires (WRAP is currently using AP-42 emission factors).

Agricultural / Rangeland Burning

Agricultural burning was not included in the 1996 WRAP Fire EI, but it is planned to be included in the 2018 Fire Emissions Inventory. Currently, there are little specific data collected on agricultural / rangeland burning by WRAP, by counties, or the state of Arizona. (See appendix for overview of recommendations for improving collection of activity data for agricultural burning emissions).

Biogenics

Maricopa County

A comparison of the WRAP estimates of biogenic VOC and NOx emissions with those developed as part of the Maricopa County ozone nonattainment area inventory for 1996 shows that WRAP EI estimates are much smaller (30 to 70 times) than the county-derived estimates. The WRAP modeling center in Riverside, California has been requested to prepare biogenic emissions, by county in Arizona, to facilitate further investigation of these large discrepancies.

Pima County

In 1998, PAG contracted with the University of Arizona to develop a biogenic emissions inventory for roughly the eastern half of Pima County. This inventory indicated that 50% of the total VOCs for this study area are emitted by biogenic sources. In contrast, for the Tucson metropolitan study area (developed urban and suburban area without surrounding elevated regions), 6% of the total VOCs are emitted by biogenic sources. Pima County biogenic emissions will be compared to the WRAP's biogenic emissions when these data are received from the WRAP Modeling Center.

Ammonia
The ammonia emission factors used for the WRAP EI are lower than those used to develop the 1994 Maricopa County PM10 inventory. Only livestock emissions could be compared, since Maricopa County did not calculate ammonia emissions from crops. The difference in the two sets of livestock emissions is proportional to the difference in emission factors, thus the activity numbers used in the WRAP EI and the 1994 Maricopa County PM10 Inventory are in good agreement.

Power Plants
The EIWG assumed that power plant emissions in the WRAP EI would be fairly accurate because these data are based on the acid rain reports submitted to U.S. agencies.

Wind Erosion
Emissions from wind erosion were not included in the 1996 WRAP EI. However, WRAP recently submitted a Request for Proposal for a contractor to add this emissions category to the WRAP EI.

CONCLUSIONS

The WRAP is to be commended for developing a comprehensive emissions inventory for the western states. The Arizona portion of the WRAP EI will be an integral part of Arizona Regional Haze SIPs submitted after Year 2003. Following are the EIWG's review and recommendations for enhancing certain emission source categories in the WRAP EI for use in Arizona Regional Haze SIPs submitted after Year 2003.

Onroad Emissions

WRAP's VMT in Maricopa County overstates Maricopa County's VMT with the discrepancy being largest for the summer season (e.g., 8% more in winter and 25% more in summer). Pima County's VMT may be also overstated (11%), and as with Maricopa County's VMT, the WRAP seasonal allocation does not agree with Pima County's data. The EIWG suggests that local VMT data be used for developing the mobile onroad emissions for Arizona Regional Haze SIPs submitted after Year 2003 with particular attention to allocating VMT by season, because Arizona does not follow the national pattern for high VMT occurring during the summer season.

Nonroad Emissions

The WRAP used an updated NONROAD model for developing their nonroad emissions. However, a new NONROAD model, to be released soon by EPA, shows significantly lower nonroad activity levels. The technical support document being developed by ENVIRON will shed more light on the differences in assumptions and models that produced the WRAP EI estimates. However, since the temporal pattern of nonroad equipment activity in Arizona can be quite different from the national average, the EIWG recommends that local Arizona nonroad emissions data be used in the Arizona Regional Haze SIPs submitted after Year 2003.

Point Sources

Emissions data for point sources, greater than 100 tons per year, in the 1996 WRAP EI were larger than the emissions data for Maricopa County, and much larger than the point source emissions data in Pima County and Pinal County emissions inventories (e.g., as much as an order of magnitude for PM10 emissions from point sources in Pima County). In July 2002, both Maricopa and Pima Counties submitted corrected point source emissions data to WRAP's contractor.

In order to ensure more accurate point and area source emission inventory reporting for future WRAP EIs, the EIWG suggests that emissions data from the state, local governments, and tribal entities be used, instead of national surrogates, for Arizona Regional Haze SIPs submitted after Year 2003. The EIWG also recommends that a decision be made whether fugitive dust emissions should be included as part of the point source inventory for Arizona Regional Haze SIPs submitted after Year 2003.

Area Sources
WRAP data for PM10 emissions from industrial processes and VOC emissions from solvent use agree well with Maricopa County data. However, WRAP emission values for NOx from stationary source fuel combustion are grossly overestimated for Maricopa County and presumably statewide. WRAP data on area source emissions for Pima County were not in good agreement with Pima County's EI data. The EIWG suggests that area source emissions in the WRAP EI be reviewed for accuracy before these data are used in Arizona Regional Haze SIPs submitted after Year 2003.

Forest Fires
The WRAP EI and Arizona Smoke Management Program may use different emission factors (but same activity data) to estimate emissions from forest fires. The EIWG suggests that forest fire emissions from the WRAP EI be compared to the Arizona Smoke Management Program's and for WRAP to lobby USEPA to use the most current emission factors for estimating emissions from forest fires.

Agricultural / Rangeland Burning
Emissions data on agricultural / rangeland burning are planned to be included in the WRAP's Year 2018 Fire EI. The EIWG suggests that the WRAP' emissions estimates for this category be used, since there are little data collected on agricultural / rangeland burning in Arizona. In the future, a statewide tracking system for the location, size, fuel type and loading, and time of burning would greatly benefit the understanding of the contribution of this emission source to regional haze.

Biogenics
The WRAP biogenic emission estimates for Maricopa County are much smaller than Maricopa County's estimates. The EIWG plans to investigate this discrepancy further after receiving biogenic emissions data grouped by counties from the WRAP modeling center.

Ammonia
Ammonia emissions from livestock in the WRAP EI appear to be reasonable when compared to Maricopa County's ammonia emissions data.

Power Plants
The EIWG assumes that the power plant emissions in the WRAP EI are fairly accurate, because these data are based on the acid rain reports submitted to U.S. agencies.

Wind Erosion
This emission category is scheduled to be added to the WRAP EI after completion of a WRAP research contract. Estimating emissions from wind erosion will entail taking into account local variations in soil type, wind patterns, precipitation patterns, vegetation growth, and topography. Due to the inherent complexity of developing wind erosion estimates for a region as large as Arizona, the EIWG suggests that the wind erosion data

produced by WRAP's contractor be used in Arizona Regional Haze SIPs submitted after Year 2003.

REFERENCES

1. ADEQ Website (Regional Haze): http://www.adeq.state.az.us/environ/air/plan/haze.html

2. WRAP Website (Emissions Forum): http://www.wrapair.org/forums/ef/index.html

3. Eastern Research Group Inc. (ERG) and Enviro-Tech Communications, technical paper, dated February 15, 2002: "Non-Burning Management Alternatives on Agricultural Lands in the Western United States, Draft Final, Prepared for The Fire Emissions Joint Forum of the Western Regional Air Partnership."

APPENDIX

Maricopa County Onroad Mobile Source Data (MAG)
The following data and assumptions were used in developing MAG's onroad emission estimates:

- The 1996 average annual vehicle miles of travel (VMT) used by WRAP in developing onroad emissions is 13% higher than comparable 1996 MAG VMT estimates and 15% higher than the Highway Performance Monitoring System (HPMS).

    - VMT from 1996 MAG traffic assignment = 58.85 million/weekday in the transportation modeling area

    - Factor to expand from MAG modeling area to Maricopa County = 1.11
        - Maricopa County average weekday VMT = 58.85 x 1.11 = 65.32 million/day
        - Factor to convert from average weekday to average annual day (including weekends) = .91
        - 1996 Maricopa County average annual daily VMT = 65.32 x .91 = 59.44 million/day
        - 1996 HPMS average annual daily VMT for Maricopa County reported to the Federal Highway Administration = 58.66 million/day
        - 1996 WRAP average annual daily VMT (from ENVIRON onroad spreadsheet) for Maricopa County = 67.26 million/day

- Seasonal variations in VMT used by WRAP are not consistent with traffic counts in Maricopa County.
    - WRAP summer season VMT in 1996 (from onroad spreadsheet) is 13% higher than winter VMT.
    - The WRAP 1996 seasonal VMT estimates are 7.5% higher than the automatic traffic recorder-based estimates in winter and 25.3% higher in summer.
    - Automated traffic recorders (ATR) in Maricopa County indicate winter season traffic is consistently higher than summer traffic.
    - Based on ATR data, the 1996 VMT in the winter was 59.04 million/day and in the summer was 57.08 million/day.

- The conclusions for Maricopa County onroad and nonroad emissions are derived from analyses of spreadsheets obtained from ENVIRON in July 2002.

Pima County Onroad Mobile Source Data (PAG)

PAG calculated the Year 2003 onroad emissions factors using the MOBILE6 emissions model with the following inputs:

- Low altitude only
- Averaging summer and winter
- Average freeway speed = 44.8 mph
- Arterial speed = 35.4 mph
- Local speed = 12.9 mph
- The MOBILE6 emission factors were then applied to the estimated VMT for each roadway type (provided by PAG-Transportation Planning Division).

Average Annual Daily VMT for Pima County

- 1996 HPMS average annual daily VMT for Pima County = 15.71 million/day
- 1996 WRAP average annual daily VMT for Pima County = 18.75 million/day, an increase of +19.4% over the HPMS data.

Seasonal VMT Allocations - Tucson Permanent Traffic Count Recorders

- March daily VMT is generally 7% higher than average daily VMT
- July daily VMT is generally 5% less than average daily VMT

Improving the Estimation of Emissions from Agricultural Burning

- As stated in the draft report, Non-Burning Management Alternatives in Agricultural Lands in the Western U.S. [3]: "...obtaining agricultural burning data presented a significant challenge... Documented agricultural burning activity data exist for only a portion of the 15-state domain, although agricultural burning is known to occur in nearly every state". Accordingly, all 15 western states should consider having mandatory organized smoke management programs that track agricultural burning activities.

- Require all sources which obtain agricultural open burn permits to expand reporting parameters to include acres burned, duration of burn, exact location, (example: section/township/range) fuel loading specifications, and crop species to permitting agencies. This should be accomplished by amending current open burn permit regulations throughout the western region.

- Capture agricultural burn permit parametric information in a regional database with a common/ consistent computerized format that can be easily utilized by various governmental agencies.

- Display agricultural burning data utilizing a geographic information system (GIS). The goal is to illustrate the level of open burning in acres and to show, county by county, burning locations and type of residue burned.

- Every state, local and tribal entity should implement a single agricultural burning reporting standard for continuity and consistency of parametric data.

- Periodic agricultural burn site visits (i.e., random checks) should be conducted by governmental personnel to verify the accuracy and completeness of burning information provided by sources.

- Resolve, or at least note differences, in permitted agricultural burn restrictions between counties or other localities. For example, Pima County and Maricopa County no longer allow the burning of agricultural fields as part of their counties' open burning programs, whereas Pinal County continues to allow burning of agricultural fields. Pima County and Maricopa County do allow burning of ditch banks.

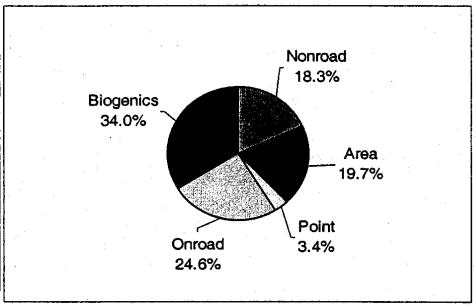
- Establish a statewide agricultural burning program for tracking agricultural burning for location, size, fuel type and loading, and time of burning. To take it a step further, this program could be used as a control measure by making daily approval / disapproval of agricultural burning similar to the Arizona Smoke Management Program for prescribed forest fires. Currently, ADEQ's statewide open burn permits are issued in advance for one year and only have restrictions on the time of day and season to conduct the agricultural burning. No data are collected on size, fuel type and loading, and time of burning as part of ADEQ's open burn permits.

Attachment 2
(tables reproduced from MAG's Analysis Supporting an Eight-Hour Ozone Boundary Option for the Maricopa County Nonattainment Area July 2003)

TABLE 2: Summary of Volatile Organic Compound (VOC) Emissions for the Maricopa County One-Hour Ozone Modeling Area

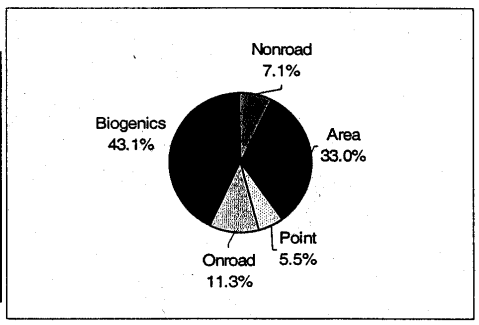
1999

Source Category	VOC (mt/day)	Percent of Total
Nonroad	83.4	18.3%
Area	89.6	19.7%
Point	15.6	3.4%
Onroad	112.1	24.6%
Biogenics	155.1	34.0%
Total	455.8	100%



2015

Source Category	VOC (mt/day)	Percent of Total
Nonroad	31.5	7.1%
Area	145.4	33.0%
Point	24.3	5.5%
Onroad	50.1	11.3%
Biogenics	190.2	43.1%
Total	441.5	100%

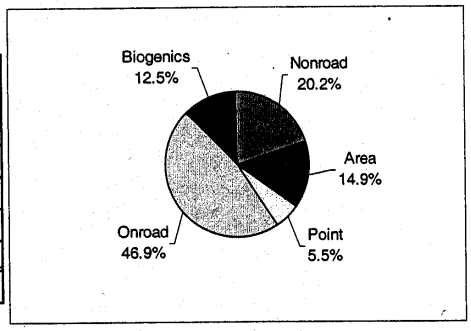


Source: Preliminary modeling for the MAG One-Hour Ozone Maintenance Plan, based on the July 17, 1999 episode.

TABLE 3: Summary of Nitrogen Oxide (NOx) Emissions for the Maricopa County One-Hour Ozone Modeling Area

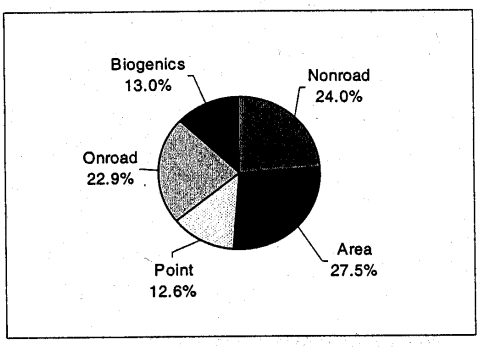
1999

Source Category	NOx (mt/day)	Percent of Total
Nonroad	61.5	20.2%
Area	45.3	14.9%
Point	16.7	5.5%
Onroad	143.1	46.9%
Biogenics	38.2	12.5%
Total	304.8	100%



2015

Source Category	NOx (mt/day)	Percent of Total
Nonroad	63.9	24.0%
Area	73.2	27.5%
Point	33.4	12.6%
Onroad	60.8	22.9%
Biogenics	34.7	13.0%
Total	266.0	100%



Source: Preliminary modeling for the MAG One-Hour Ozone Maintenance Plan, based on the July 17, 1999 episode.